WHAT IS CLAIMED IS:

A polynomial predistorter for predistorting a complex modulated baseband signal, providing the predistorted signal to a power amplifier, and
compensating for the non-linear distortion characteristic of the power amplifier using complex vector multiplication, comprising:

a first complex multiplier for generating first complex predistortion gains using a current input signal and complex polynomial coefficients, for in-phase (I) predistortion and quadrature-phase (Q) predistortion, the complex polynomial coefficients being modeled on the inverse non-linear distortion characteristic of the power amplifier, and multiplying the first complex predistortion gains by I and Q signal components of the current input signal, respectively;

at least one second complex multiplier for generating second complex predistortion gains using the complex polynomial coefficients and previous predistorted signals corresponding to the complex polynomial coefficients, for the I predistortion and the Q predistortion, and multiplying the second complex predistortion gains by I and Q signal components of the previous predistorted signals, respectively; and

a summer for generating a predistorted signal by summing outputs of the first and second complex multipliers and outputting the predistorted signal to the power amplifier.

- 2. The polynomial predistorter of claim 1, wherein the complex polynomial coefficients are determined such that the predistorted signal is output 25 to an input of an amplifier output.
 - 3. The polynomial predistorter of claim 1, wherein the predistorted signal is calculated using

$$\begin{split} d(n) &= d_i(n) + jd_q(n) = x(n)E(c_i + jc_q) \\ x(n) &= [x_i(n), x_q(n), x_i(n) \big| x(n) \big|, x_q(n) \big| x(n) \big|, ..., x_i(n) \big| x(n) \big|^{P-1}, x_q(n) \big| x(n) \big|^{P-1}, \\ d_i(n-1), d_q(n-1), d_i(n-1) \big| d(n-1) \big|, d_q(n-1) \big| d(n-1) \big|, ..., \\ d_i(n-1) \big| d(n-1) \big|^{P-1}, d_q(n-1) \big| d(n-1) \big|^{P-1}, \\ d_i(n-M), d_q(n-M), d_i(n-M) \big| d(n-M) \big|, d_q(n-M) \big| d(n-M) \big|, ..., \\ d_i(n-M) \big| d(n-M) \big|^{P-1}, d_q(n-M) \big| d(n-M) \big|^{P-1} \end{split}$$

$$\begin{split} \mathbf{c_{i}} &= [\mathbf{c_{ii,0,0}}, \mathbf{c_{iq,0,0}}, ..., \mathbf{c_{ii,0,(P-1)}}, \mathbf{c_{iq,0,(P-1)}}, \mathbf{c_{ii,1,0}}, \mathbf{c_{iq,1,0}}, ..., \mathbf{c_{ii,1,(P-1)}}, \mathbf{c_{iq,1,(P-1)}}, ..., \\ & \mathbf{c_{ii,M,0}}, \mathbf{c_{iq,M,0}}, ..., \mathbf{c_{ii,M,(P-1)}}, \mathbf{c_{iq,M,(P-1)}}]^T \\ \mathbf{c_{q}} &= [\mathbf{c_{qi,0,0}}, \mathbf{c_{qq,0,0}}, ..., \mathbf{c_{qi,0,(P-1)}}, \mathbf{c_{qq,0,(P-1)}}, \mathbf{c_{qi,1,0}}, \mathbf{c_{qq,1,0}}, ..., \mathbf{c_{qi,1,(P-1)}}, \mathbf{c_{qq,1,(P-1)}}, ..., \\ & \mathbf{c_{qi,M,0}}, \mathbf{c_{qq,M,0}}, ..., \mathbf{c_{qi,M,(P-1)}}, \mathbf{c_{qq,M,(P-1)}}]^T \end{split}$$

where d(n) is the predistorted signal including an I signal component d_i(n) and a S q signal component d_q(n), x(n) is the input signal including an I signal component x_i(n) and a Q signal component x_q(n), c_i is an I polynomial coefficient including c_{ii} and c_{iq} that affect x_i(n) and x_q(n), respectively, c_q is a Q polynomial coefficient including c_{qi} and c_{qq} that affect x_i(n) and x_q(n), respectively, P is the order of the polynomial, and M is the number of previous signals to consider.

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- 4. The polynomial predistorter of claim 1, wherein each of the first and second complex predistortion gains includes an I complex predistortion gain and a Q complex predistortion gain which are multiplied respectively by the I and Q signal components of the input signal and the previous predistorted signals.
 - 5. The polynomial predistorter of claim 4, wherein the first complex predistortion gains are calculated using

$$\begin{split} p &= c_{ii,0,0} + c_{ii,0,1} \big| x(n) \big| + ... + c_{ii,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ q &= c_{iq,0,0} + c_{iq,0,1} \big| x(n) \big| + ... + c_{iq,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ r &= c_{qi,0,0} + c_{qi,0,1} \big| x(n) \big| + ... + c_{qi,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ s &= c_{qq,0,0} + c_{qq,0,1} \big| x(n) \big| + ... + c_{qq,0,(P-1)} \big| x(n) \big|^{(P-1)} \end{split}$$

where x(n) is the input signal, p and q are I predistortion gains by which the I and Q signal components of the input signal are multiplied, r and s are Q predistortion gains by which the I and Q signal components of the input signal are multiplied, c_{ii} and c_{iq} are I polynomial coefficients that affect the I and Q signal components of the input signal, respectively, c_{qi} and c_{qq} are Q polynomial coefficients that affect the I and Q signal components of the input signal, respectively, P is the order of the polynomial, and M is the number of previous signals to consider.

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6. The polynomial predistorter of claim 4, wherein the second complex predistortion gains are calculated using

$$\begin{split} \mathbf{p} &= \mathbf{c}_{ii,m,0} + \mathbf{c}_{ii,m,1} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big| + ... + \mathbf{c}_{ii,m,(P-1)} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big|^{(P-1)} \\ \mathbf{q} &= \mathbf{c}_{iq,m,0} + \mathbf{c}_{qi,m,1} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big| + ... + \mathbf{c}_{iq,m,(P-1)} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big|^{(P-1)} \\ \mathbf{r} &= \mathbf{c}_{qi,m,0} + \mathbf{c}_{qi,m,1} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big| + ... + \mathbf{c}_{qi,m,(P-1)} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big|^{(P-1)} \\ \mathbf{s} &= \mathbf{c}_{qq,m,0} + \mathbf{c}_{qq,m,1} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big| + ... + \mathbf{c}_{qq,m,(P-1)} \big| \mathbf{d}(\mathbf{n} - \mathbf{m}) \big|^{(P-1)} \end{split}$$

where d(n-m) is an mth previous predistorted signal, p and q are I predistortion gains by which the I and Q signal components of the input signal are multiplied, r and s are Q predistortion gains by which the I and Q signal components of the input signal are multiplied, c_{ii} and c_{iq} are I polynomial coefficients that affect the I and Q signal components of the input signal, respectively, c_{qi} and c_{qq} are Q polynomial coefficients that affect the I and Q signal components of the input signal, respectively, P is the order of the polynomial, and M is the number of previous signals to consider.

7. A polynomial predistorting method of predistorting a complex modulated baseband signal, providing the predistorted signal to a power amplifier, and compensating for the non-linear distortion characteristic of the power amplifier using complex vector multiplication, comprising the steps of:

generating first complex predistortion gains using a current input signal and complex polynomial coefficients, for in-phase (I) predistortion and quadrature-phase (Q) predistortion, the complex polynomial coefficients being modeled on the inverse non-linear distortion characteristic of the power amplifier, and multiplying the first complex predistortion gains by I and Q signal 10 components of the current input signal, respectively;

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generating second complex predistortion gains using the complex polynomial coefficients and a predetermined number of previous predistorted signals, for the I predistortion and the Q predistortion, and multiplying the second complex predistortion gains by I and Q signal components of the previous 15 predistorted signals, respectively; and

generating a predistorted signal by summing outputs of the first and second complex multipliers and outputting the predistorted signal to the power amplifier.

- 20 8. The polynomial predistorting method of claim 7, wherein the complex polynomial coefficients are determined such that the predistorted signal is output to an input of an amplifier output.
- 9. The polynomial predistorting method of claim 7, wherein the 25 predistorted signal is calculated using

$$d(n) = d_i(n) + jd_q(n) = x(n)E(c_i + jc_q)$$

$$\begin{split} x(n) = & [x_i(n), x_q(n), x_i(n) \big| x(n) \big|, x_q(n) \big| x(n) \big|, ..., x_i(n) \big| x(n) \big|^{P-1}, x_q(n) \big| x(n) \big|^{P-1}, \\ & d_i(n-1), d_q(n-1), d_i(n-1) \big| d(n-1) \big|, d_q(n-1) \big| d(n-1) \big|, ..., \\ & d_i(n-1) \big| d(n-1) \big|^{P-1}, d_q(n-1) \big| d(n-1) \big|^{P-1}, \\ & d_i(n-M), d_q(n-M), d_i(n-M) \big| d(n-M) \big|, d_q(n-M) \big| d(n-M) \big|, ..., \\ & d_i(n-M) \big| d(n-M) \big|^{P-1}, d_q(n-M) \big| d(n-M) \big|^{P-1} \end{split}$$

$$\begin{split} c_{i} &= [c_{ii,0,0}, c_{iq,0,0}, ..., c_{ii,0,(P-1)}, c_{iq,0,(P-1)}, c_{ii,1,0}, c_{iq,1,0}, ..., c_{ii,1,(P-1)}, c_{iq,1,(P-1)}, ..., \\ & c_{ii,M,0}, c_{iq,M,0}, ..., c_{ii,M,(P-1)}, c_{iq,M,(P-1)}]^T \\ c_{q} &= [c_{qi,0,0}, c_{qq,0,0}, ..., c_{qi,0,(P-1)}, c_{qq,0,(P-1)}, c_{qi,1,0}, c_{qq,1,0}, ..., c_{qi,1,(P-1)}, c_{qq,1,(P-1)}, ..., \\ & c_{qi,M,0}, c_{qq,M,0}, ..., c_{qi,M,(P-1)}, c_{qq,M,(P-1)}]^T \end{split}$$

where d(n) is the predistorted signal including an I signal component $d_i(n)$ and a Q signal component $d_q(n)$, x(n) is the input signal including an I signal component $x_i(n)$ and a Q signal component $x_q(n)$, c_i is an I polynomial coefficient including c_{ii} and c_{iq} that affect $x_i(n)$ and $x_q(n)$, respectively, c_q is a Q polynomial coefficient including c_{qi} and c_{qq} that affect $x_i(n)$ and $x_q(n)$, respectively, P is the order of the polynomial, and M is the number of previous signals to consider.

10. The polynomial predistorting method of claim 7, wherein each of the first and second complex predistortion gains includes an I complex predistortion gain and a Q complex predistortion gain which are multiplied respectively by the I and Q signal components of the input signal and the previous predistorted signals.

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11. The polynomial predistorting method of claim 10, wherein the first complex predistortion gains are calculated using

$$\begin{split} p &= c_{ii,0,0} + c_{ii,0,1} \big| x(n) \big| + ... + c_{ii,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ q &= c_{iq,0,0} + c_{iq,0,1} \big| x(n) \big| + ... + c_{iq,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ r &= c_{qi,0,0} + c_{qi,0,1} \big| x(n) \big| + ... + c_{qi,0,(P-1)} \big| x(n) \big|^{(P-1)} \\ s &= c_{qq,0,0} + c_{qq,0,1} \big| x(n) \big| + ... + c_{qq,0,(P-1)} \big| x(n) \big|^{(P-1)} \end{split}$$

where x(n) is the input signal, p and q are I predistortion gains by which the I and Q signal components of the input signal are multiplied, r and s are Q predistortion gains by which the I and Q signal components of the input signal are multiplied, c_{ii} and c_{iq} are I polynomial coefficients that affect the I and Q signal components of the input signal, respectively, c_{qi} and c_{qq} are Q polynomial coefficients that affect the I and Q signal components of the input signal, respectively, P is the order of the polynomial, and M is the number of previous signals to consider.

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12. The polynomial predistorting method of claim 10, wherein the second complex predistortion gains are calculated using

$$\begin{split} p &= c_{ii,m,0} + c_{ii,m,1} \big| d(n-m) \big| + ... + c_{ii,m,(P-1)} \big| d(n-m) \big|^{(P-1)} \\ q &= c_{iq,m,0} + c_{qi,m,1} \big| d(n-m) \big| + ... + c_{iq,m,(P-1)} \big| d(n-m) \big|^{(P-1)} \\ r &= c_{qi,m,0} + c_{qi,m,1} \big| d(n-m) \big| + ... + c_{qi,m,(P-1)} \big| d(n-m) \big|^{(P-1)} \\ s &= c_{qq,m,0} + c_{qq,m,1} \big| d(n-m) \big| + ... + c_{qq,m,(P-1)} \big| d(n-m) \big|^{(P-1)} \end{split}$$

where d(n-m) is an mth previous predistorted signal, p and q are I predistortion gains by which the I and Q signal components of the input signal are multiplied, r and s are Q predistortion gains by which the I and Q signal components of the input signal are multiplied, c_{ii} and c_{iq} are I polynomial coefficients that affect the I and Q signal components of the input signal, respectively, c_{qi} and c_{qq} are Q polynomial coefficients that affect the I and Q signal components of the input signal, respectively, P is the order of the polynomial, and M is the number of previous signals to consider.